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PIC/JR-1020/61 is reissued to correct an error on page 10 (Figure 6). It replaces the identically numbered report, copies of which should be destroyed.

PIC/JR-1020/61
May 1961 25X1

JOINT PHOTOGRAPHIC INTELLIGENCE REPORT

FIVE SOVIET HIGH-FREQUENCY BROADCASTING STATIONS

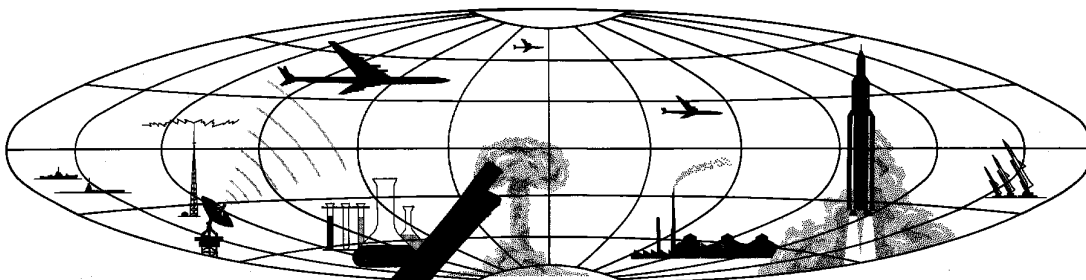


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PREFACE

This joint photographic intelligence report has been prepared by the Army, Navy, and Central Intelligence Agency in response to requests for a photographic analysis of five selected high-frequency broadcasting stations located at Novosibirsk, Alma-Ata, Stalinabad, Tbilisi, and Komsomolsk, USSR.

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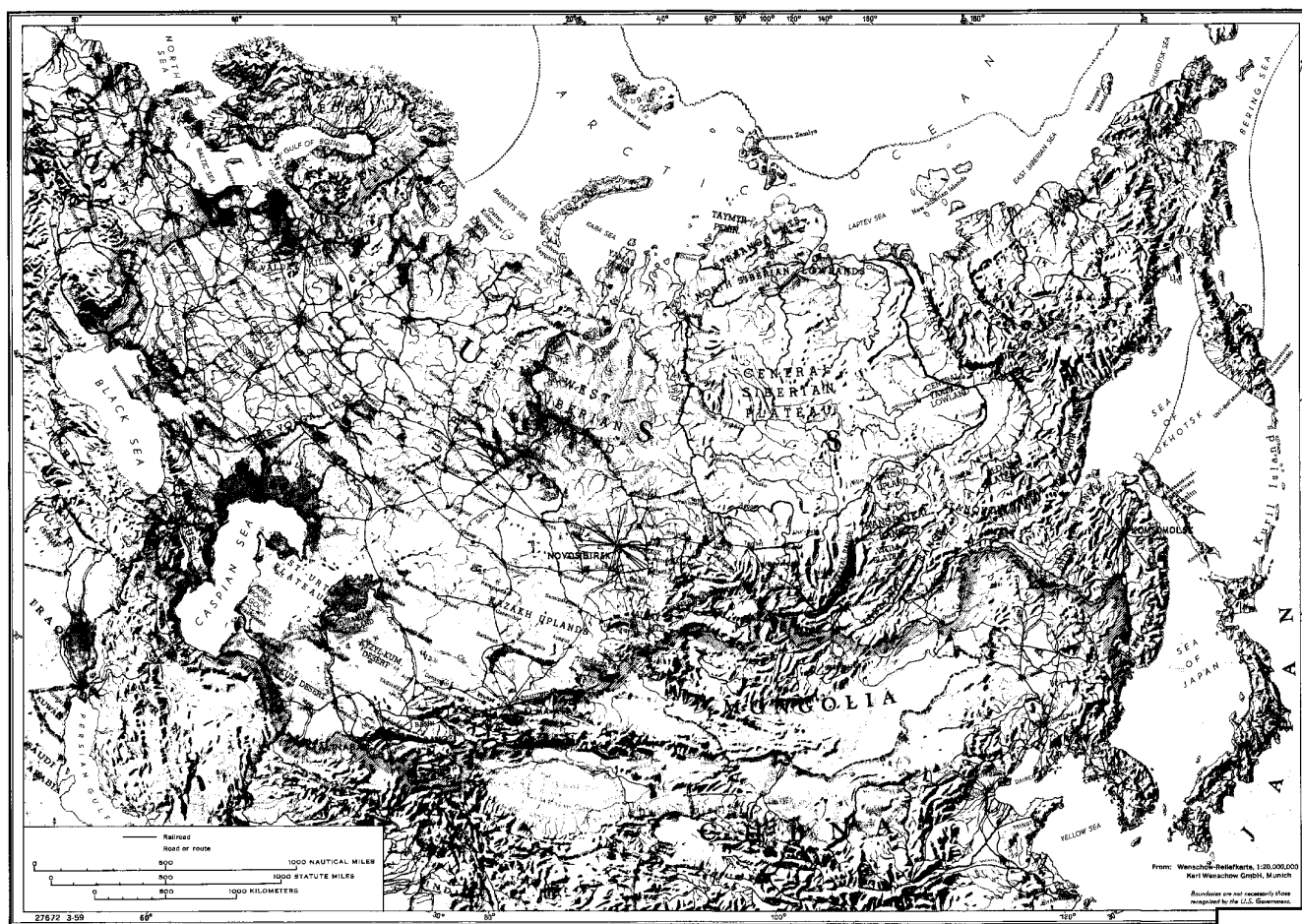


FIGURE 1. GENERAL ORIENTATION MAP. This map shows the location of the five high-frequency broadcasting stations discussed in this report.

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INTRODUCTION

This report is based on 1957 and 1958 aerial photography of five selected, similarly designed high-frequency broadcasting stations located at major com-

munications centers in the USSR. These centers are Novosibirsk, Alma-Ata, Stalinabad, Tbilisi, and Komsomolsk (see general orientation map, Figure 1). A

sixth station of similar design, located at Tashkent, and a seventh station, located at Sverdlovsk, are described in other reports. 1/ 2/ Since the self-supporting

lattice towers at all five stations are identical except for measurements, they are described in detail only under the first station -- Novosibirsk.

SUMMARY

In the design of the five high-frequency broadcasting stations described in this report, attention apparently has been focused on flexibility, a high degree of standardization, and maximum plant usage. These have been achieved in the following manner: (1) by erecting two separate groups of lattice towers, probably for separate frequency range bands; (2) by antenna switching; (3) by construction of two identical transmitter buildings; and (4) by the common utilization of power, water, and general support facilities.

Each station exhibits similar physical

characteristics, although the layout, number of towers, and other facilities vary, probably on the basis of the requirement of the particular station. A major similarity of each station is that each has two roughly parallel groups of self-supporting lattice towers, from which high-frequency curtain arrays are suspended. Also, one group is predominantly taller than the other, and at all but one station (Komsomolsk) there are two identical transmitter buildings.

All but one of the five stations (that at Komsomolsk) appear to be in various stages of construction. Some

of those under construction may be in partial operation. The large size of each station indicates an extended effort by the USSR to increase its high-frequency broadcasting capability. Also, it is to be noted that azimuthal orientations of some of the antennas at these stations are only a few degrees apart. This fact indicates that the stations may use space diversity transmissions.

These five stations may serve one or more of the following functions: international broadcasting, domestic broadcasting, and jamming. A significant increase in multilingual Soviet broad-

casting to Asia and Africa was noted in

Radio Moscow increased its output to the Middle East (Iran) from Stalinabad and Tashkent. 3/ The Tashkent area is completely covered by aerial photography, and the high-frequency broadcasting station near Tashkent (similar to the type discussed in this report) is the only Tashkent station which is oriented toward the Middle East and which is suitable for international broadcasting.

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NOVOSIBIRSK HIGH-FREQUENCY BROADCASTING STATION

This station is located at 54-55N 82-52E, 7 nautical miles south of Novosibirsk (see location map, Figure 2). It is situated on nearly level terrain, approximately 500 feet above sea level.

each with 2 associated cooling ponds; and miscellaneous storage/support-type buildings. A 30-foot-wide paved road serves the station and connects with the road net leading to the urban area of Novosibirsk.

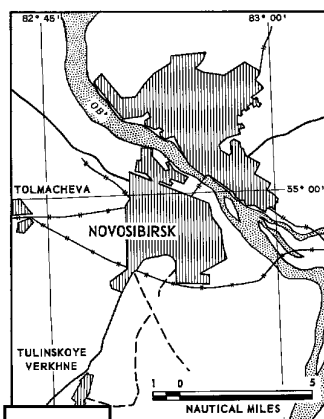


FIGURE 2. LOCATION MAP SHOWING THE NOVOSIBIRSK STATION

The station includes a fenced operations area and a housing and administration area (see photograph, Figure 3). The operations area is roughly rectangular and covers approximately 400 acres (8,300 by 2,100 feet). Security measures for this area consist of a perimeter fence with five guard towers and a check point at the entrance. The area contains 39 self-supporting lattice towers, arranged in two groups, from which high-frequency curtain arrays are suspended; 4 rhombic antennas; 2 identical transmitter buildings,

OPERATIONS AREA

Antennas

Curtain Arrays: The 39 self-supporting lattice towers are arranged in two groups, designated as Tower Groups "A" and "B" (see line drawing, Figure 4). Both groups are oriented north-northeast/south-southwest and are generally parallel. The towers range in height from to 365 feet. In some places the tower groups are as near to each other as 1,100 feet and in other places as far apart as 1,800 feet. Neither group duplicates the spacing or arrangement of the other. The towers in Group "A" are more uniform in height and spacing than those in Group "B".

Tower Group "A," which consists of 17 self-supporting lattice towers (items 1-17) extending over a straight-line distance of 5,100 feet (accumulated, 5,860 feet), is located along the eastern side of the operations area. Each tower supports parallel horizontal crossarms (see perspective drawing, Figure 5). The positioning of these towers and the spacing of the crossarms indicate that the towers support curtain arrays. The topmost crossarm supports the cables which are

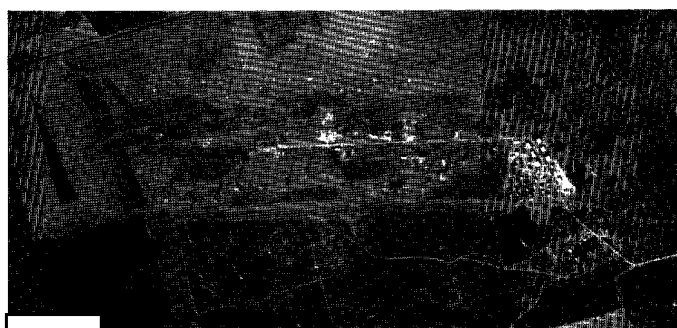


FIGURE 3. PHOTOGRAPH OF THE NOVOSIBIRSK STATION

being used to suspend and hold the antennas vertically. Horizontal tension is probably maintained by steel cables on the subsequent lower crossarms. Towers 1 and 2 support top crossarms 20 feet long and towers 3-17 support top crossarms [redacted]. Smaller horizontal crossarms are positioned along the vertical axis of each tower. The bases of towers 1 and 2 are 20 feet square and of towers 3-17, [redacted]. Between towers 4 and 5, 5 and 6, 10 and 11, and 14 and 15 are small unidentified objects, probably switching and phase-changing devices. This suggests that the curtain arrays may be capable of transmitting in two directions. Table 1 gives the azimuth orientation of a perpendicular to a line projected from one tower to the next, together with the tower measurements (tower numbers are keyed to Figure 4).

from which curtain arrays are suspended. Towers 21-28, and 32-39 support top crossarms which measure [redacted]. The length of the top crossarms on towers 18-20 and 29-31 cannot be determined. The bases of towers 21-27 and 32-39 measure [redacted] and the bases of towers 18-20 and 28-31 measure [redacted].

Again, as in Tower Group "A," probable switching and phase-changing devices are positioned on the ground (between towers 29 and 30, 33 and 34,

Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
1	[redacted]	270	[redacted]
2	225	270	085/285
3	365	350	075/285
4	365	350	[redacted]
5	365	350	
6	365	350	
7	365	350	
8	365	350	

Again, as in Tower Group "A," probable switching and phase-changing devices are positioned on the ground (between towers 29 and 30, 33 and 34,

TABLE 1. DATA ON TOWER GROUP "A," NOVOSIBIRSK

Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
1		270	
2	225	270	085/285
3	365	350	
4	365	380	
5	365	380	
6	365	380	
7	365	380	
8	365	380	
9	365	380	
10	365	380	
11	365	380	
12	365	380	
13	365	290	
14	365	380	
15	365	380	
16	365	380	
17	365	380	110/290
			175/355

* Perpendicular to a line projected between centers of towers.

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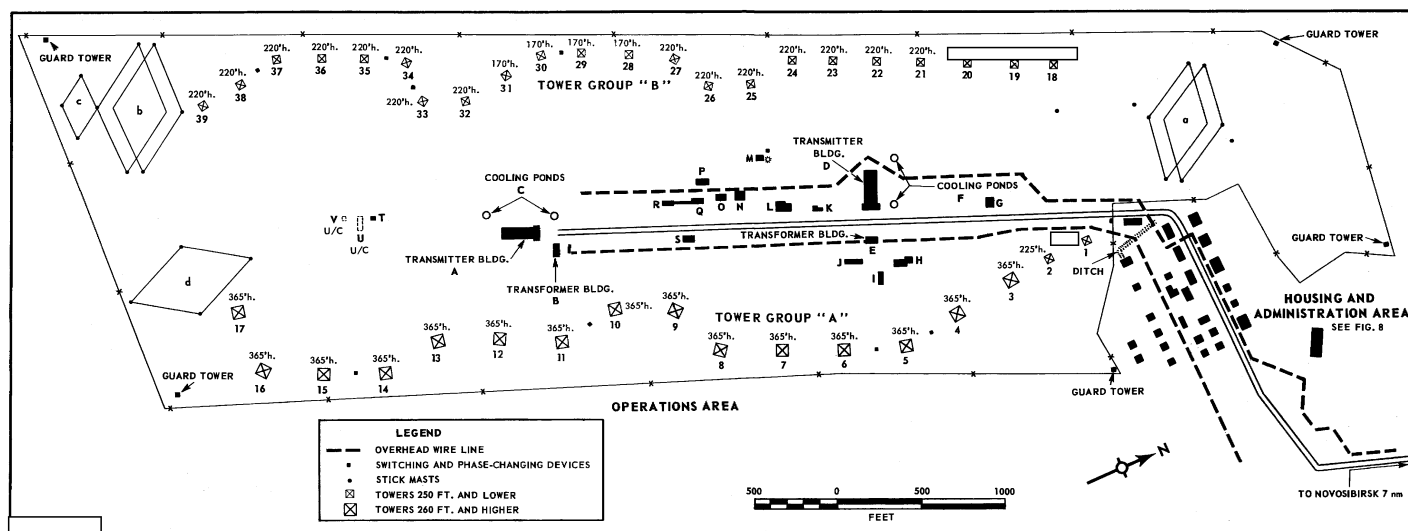


FIGURE 4. OPERATIONS AREA AT THE NOVOSIBIRSK STATION. This drawing shows the 39 self-supporting lattice towers.

TABLE 2. DATA ON TOWER GROUP "B", NOVOSIBIRSK			
Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
18		250	
19		295	110/290
20		295	110/290
21	220	265	
22	220	265	
23	220	265	110/290
24	220	265	110/290
25	220	295	
26	220	265	110/290
27	220	265	160/330
28	170	295	
29	170	250	110/290
30	170	250	
31	170	295	
32	220	265	
33	220	265	
34	220	265	
35	220	265	
36	220	265	110/290
37	220	265	
38	220	265	
39	220	265	

* Perpendicular to a line projected between centers of towers.

34 and 35, and 37 and 38), suggesting that the curtain arrays may be capable of transmitting in two directions. Table 2 gives the azimuth orientation of a perpendicular to a line projected from one tower to the next, together with the tower measurements (tower numbers are keyed to Figure 4).

In Tables 1 and 2, both front and back azimuthal readings are tabulated. These azimuths are grouped, tabulated for both tower groups, and totaled in Table 3.

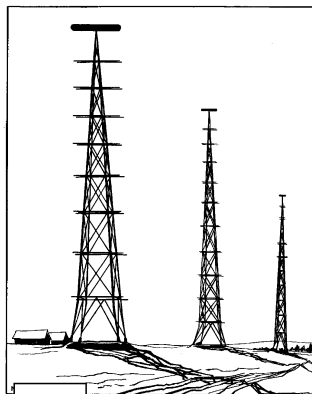


FIGURE 5. PERSPECTIVE DRAWING OF SELF-SUPPORTING LATTICE TOWER. Each of the five stations discussed in this report has two groups of towers of this type. The towers support high-frequency curtain arrays.

The above azimuths have been averaged and plotted on a gnomonic projection map which indicates the general areas which may be covered by the arrays suspended from the towers (see Figure 6).

Rhombic Antennas: Two single and two double rhombic antennas are located in the operations area. One double rhombic is located in the northern end of the area, and one double and two single rhombics in the southern end. One double and one single rhombic are arranged in a pair for day and night frequencies. No feed or dissipation lines can be identified. Rhombic antenna measurements are listed in Table 4 (antennas are keyed to Figure 4, and their orientations are shown on the map, Figure 6).

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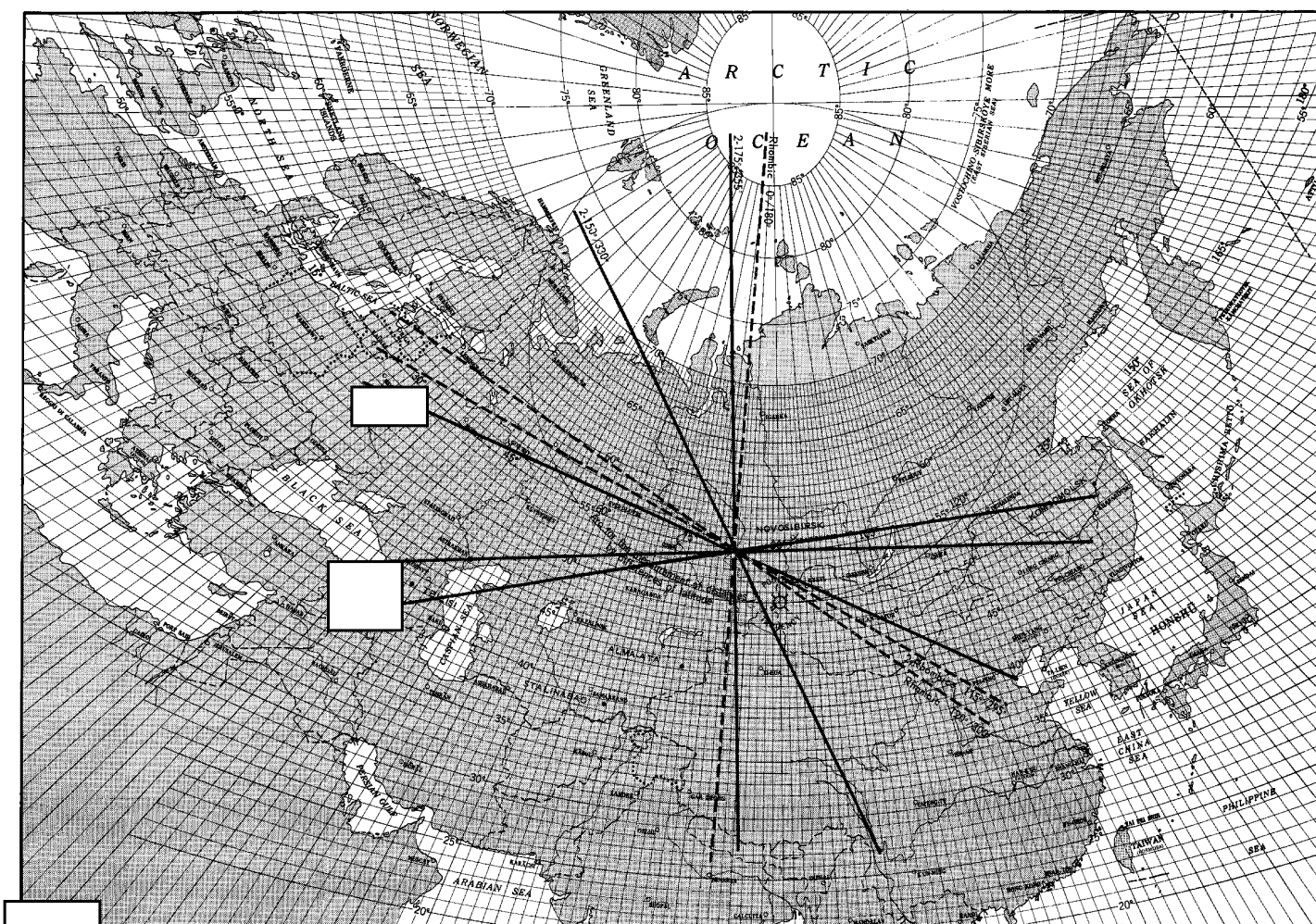


FIGURE 6. GNOMONIC PROJECTION MAP, showing areas covered by antennas of Novosibirsk high-frequency broadcasting station.

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TABLE 4. DATA ON RHOMBIC ANTENNAS, NOVOSIBIRSK								
Antenna	Major Axis (ft.)	Minor Axis (ft.)	Length of One Side (ft.)	Distance Between End Poles (ft.)	Height of End Poles (ft.)	Height of Side Poles (ft.)	Computed Tilt Angle (°)	Orientation of Major Axis (°)
a	710	355	400		90-100	115		120/300
b*	720	400	400		80	115		115/295
c	475	310	285		75	75		115/295
d*	760	400	430		85	85		000/180

*Approximate measurements

Structures

The two transmitter buildings (Figure 4, items A and D) are situated between the two tower groups and are connected by a service road. For a perspective of this type of building, see Figure 7.

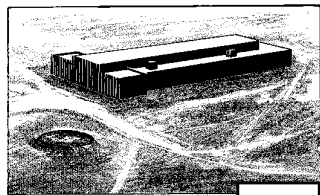


FIGURE 7. PERSPECTIVE DRAWING OF MONITOR-ROOFED TRANSMITTER BUILDING. Two identical buildings of this type are located at four of the five stations covered in this report.

Associated with transmitter building A is a transformer building (item B) and two cooling ponds (item C). Transmitter building A has a modified T-shaped appearance, measures [redacted] and [redacted] and provides 17,710 square feet of covered floor space. This building has a flat roof with a flat-roofed longitudinal monitor which is [redacted] probably for ventilation and light. Two vents [redacted] and 100 feet apart are located on the western side of the lower roof. The two cooling ponds, 55 feet in diameter and 440 feet apart, are located outside the building on the same side as the vents in the roof. In the center of each pond is a fountain used to facilitate the cooling of the water.

Transformer building B, located 110 feet in front of transmitter building A, is a gable-roofed building [redacted] and [redacted] with a chimneylike structure extending upward from the roof of either end of the northern side of the building.

Associated with transmitter building D is transformer building E and two cooling ponds (item F), which are identical to those associated with transmitter building A and described above, except that the ponds are closer together and the transformer building is farther from the transmitter building.

It is impossible to identify any feed lines from the transmitter buildings to any of the towers, rhombic antennas, or probable switching and phase-changing devices. Thus it cannot be determined which antennas are used by a particular transmitter building. Also within the operations area, besides the transmitter and transformer buildings and ponds, are 16 miscellaneous buildings which provide a total covered floor space of 33,730 square feet. A description of each building is given in Table 5 (buildings are keyed to Figure 4).

Overhead Power and/or Communications Lines

Two overhead wire lines enter the station from the northeast. These lines supply power and possibly land-line com-

TABLE 5. STRUCTURES IN OPERATIONS AREA, NOVOSIBIRSK

Building	Description	Dimensions (ft.)	Function
A	One story, monitor roof	[redacted]	Transmitter bldg.
B	One story, gable roof	[redacted]	Transformer bldg.
C	Two ponds	55 dia.	Cooling ponds
D	One story, monitor roof	[redacted]	Transmitter bldg.
E	One story, gable roof	[redacted]	Transformer bldg.
F	Two ponds	55 dia.	Cooling ponds
G	One story, gable roof	[redacted]	Undetermined
H	One story, gable roof, shed	[redacted]	Undetermined
I	One story, flat roof	[redacted]	Storage bldg.
J	One story, flat roof	[redacted]	Storage/maintenance bldg.
K	Bi-level, flat roof	55 x 25	Undetermined
L	One story, hipped roof, w/60' mast	100 x 50	Probable administration or local communications bldg.
M	One story, flat roof	[redacted]	Undetermined; earth mound, probable buried tank 18' in dia., and small shed near bldg.
N	One story, gable roof	65 x 60	Storage/maintenance bldg.
O	One story, flat roof	[redacted]	Storage bldg.
P	One story, gable roof	[redacted]	Storage bldg.
Q	One story, gable roof	75 x 30	Undetermined; connected to bldg. R by a 120' long x 10' wide partially covered passageway.
R	One story, flat roof	[redacted]	Possible batch plant; served by an embanked earthen ramp; two excavations near base.
S	One story, gable roof	[redacted]	Storage/maintenance bldg.
T	One story, hipped roof	15 x 15	Undetermined
U	One story, gable roof, U/C	[redacted]	Undetermined
V	One story, gable roof, U/C	20 x 20	Undetermined

*monitor

**shed

munications to the station. Both lines appear to emanate from a wire line located 2 nautical miles from the station. For one of these two lines, which supply both transformer buildings, there are masts averaging 55 feet high and spaced at intervals of 450 feet outside of the station and 300 feet apart within the operations area. For the other line there are poles averaging 50 feet high and spaced at irregular intervals but not more than 350 feet apart.

HOUSING AND ADMINISTRATION AREA

The housing and administration area (see line drawing, Figure 8) is located outside the operations area at its northeast corner. There are 31 buildings in this area, totaling over 94,000 square feet of floor space. Eighteen buildings appear to be used for housing. These houses consist of 56 family-type units and sufficient billets for 100 personnel. A description of each building is given in Table 6 (building numbers are keyed to Figure 8).

TABLE 6. STRUCTURES IN HOUSING AND ADMINISTRATION AREA, NOVOSIBIRSK			
Building	Description	Dimensions (ft.)	Function
1-10	10 structures, single story, gable roof, 4 vents on each	45 x 35	2-family housing
11	One story, gable roof, one vent	50 x 40	Undetermined
12	One story, flat roof, extended front	75 x 40	Possible communal hall
13	One story, flat roof	65 x 25	Maintenance bldg.
14	One story, L-shaped gable roof	50 x 35, *35 x 35	Storage bldg.
*leg			continued

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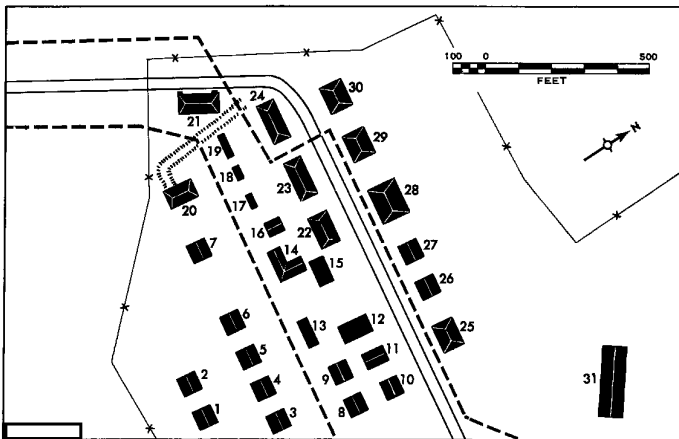


FIGURE 8. HOUSING AND ADMINISTRATION AREA AT THE NOVOSIBIRSK STATION. Figure 4 shows the location of this area in relation to the operations area.

TABLE 8. (CONTINUED)							
Building	Description	Dimensions (ft.)	Function	Building	Description	Dimensions (ft.)	Function
15	One story, flat roof	65 x 35	Possible vehicle shed	24	Multistory, hipped roof, w/4 dormers	90 x 40	Barracks
16	One story, gable roof	35 x 25	Storage bldg.	25	Multistory, hipped roof, w/4 dormers	85 x 55	8-family apartment
17	One story, flat roof	30 x 20	Undetermined	26	One story, gable roof, w/4 vents	45 x 35	2-family housing
18	One story, flat roof	30 x 20	Undetermined	27	One story, gable roof, w/4 vents	45 x 35	2-family housing
19	One story, flat roof	65 x 30	Undetermined	28	Multistory, hipped roof, w/4 dormers	85 x 60	8-family apartment
20	Multistory, hipped roof, w/open ditch	75 x 45	Executive quarters	29	Multistory, hipped roof, w/4 dormers	75 x 55	8-family apartment
21	One story, hipped roof, one vent, and 2 gabled entrances	90 x 40	Possible mess hall	30	Multistory, hipped roof w/4 dormers	75 x 55	8-family apartment
22	Multistory, hipped roof, w/4 dormers	80 x 50	Administration bldg.	31	One story, gable roof	150 x 50	Warehouse
23	Multistory, hipped roof, w/4 dormers	90 x 40	Barracks				

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ALMA-ATA HIGH-FREQUENCY BROADCASTING STATION

This station is located at 43-30N 77-00E, 13 nautical miles north of Alma-Ata (see location map, Figure 9). The station includes a fenced operations area

and miscellaneous storage-support-type buildings. The station is served by an all-weather road from Alma-Ata.

OPERATIONS AREA

Antennas

Curtain Arrays: The 26 self-supporting lattice towers and 4 tower bases are arranged in two groups, designated as Tower Groups "A" and "B" (see line drawing, Figure 11). The two tower groups are roughly parallel, but neither group duplicates the spacing or arrangement of the other. Small unidentified objects located between the towers are probable switching and phase-changing devices. Except in measurements, these towers are identical to those at Novosibirsk (see page 9).

Tower Group "A" consists of nine self-supporting lattice towers (items 1-6 and 8-10) and concrete bases for four additional towers (items 7 and 11-13). All tower bases measure approximately [redacted] and top crossarms measure approximately 45 feet in length. This group is situated in a relatively straight line along the eastern edge of the operations area and is oriented south-southwest/north-northeast. Tower Group "A" dimensions are given in Table 7 (tower numbers are keyed to Figure 11).

Tower Group "B" consists of 17 self-supporting lattice towers (items 14-30) arranged in a relatively straight line and located on the western edge of the

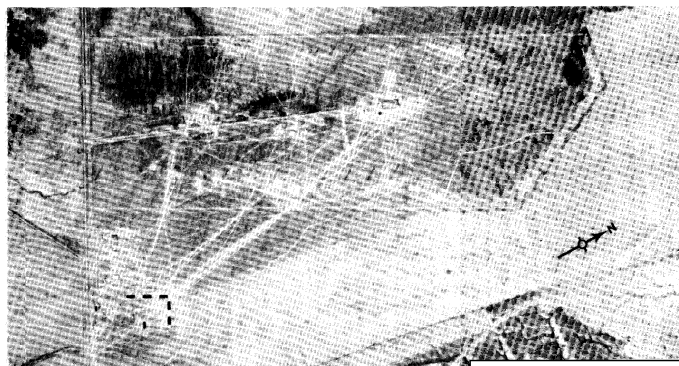


FIGURE 10. PHOTOGRAPH OF THE ALMA-ATA STATION.

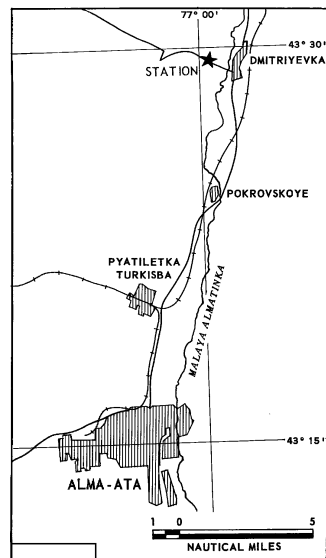


FIGURE 9. LOCATION MAP SHOWING THE ALMA-ATA STATION.

and a housing and administration area (see photograph, Figure 10). The operations area is roughly rectangular and covers approximately 470 acres (7,500 by 2,750 feet). It contains 26 self-supporting lattice towers, arranged in two tower groups, which support high-frequency curtain arrays; bases for 4 additional towers; 6 rhombic antennas; 2 transmitter buildings;

TABLE 7. DATA ON TOWER GROUP "A", ALMA-ATA			
Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
1	350	380	
2	350	375	
3	350	375	
4	350	375	
5	350	375	
6	350	390	
7	U/C	375	
8	350	375	
9	350	375	
10	350	375	110/290
11	U/C	375	135/315
12	U/C	375	135/315
13	U/C	375	135/315

*Perpendicular to a line projected between centers of towers.

TABLE 8. DATA ON TOWER GROUP "B", ALMA-ATA			
Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
14	210	255	
15	210	260	
16	210	285	
17	150	285	
18	125	245	130/310
19	150	235	
20	210	290	
21	210	260	
22	210	260	
23	210	245	
24	210	255	
25	210	255	
26	210	260	110/290
27	100**	280	
28	210	285	
29	210	255	135/315
30	210	255	135/315

*Perpendicular to a line projected between centers of towers.

**Tower probably under construction.

operations area. Group "B" is oriented in the same general direction as Group "A." Tower bases measure approximately 20 feet square, and the top crossarms are approximately 20 feet in length. Dimensions of Tower Group "B" are given in Table 8 (tower numbers are keyed to Figure 11).

In Tables 7 and 8, both front and back azimuthal readings are tabulated. These azimuths are grouped, tabulated for both tower groups, and totaled in Table 9.

The above azimuths have been averaged and plotted on a gnomonic projection

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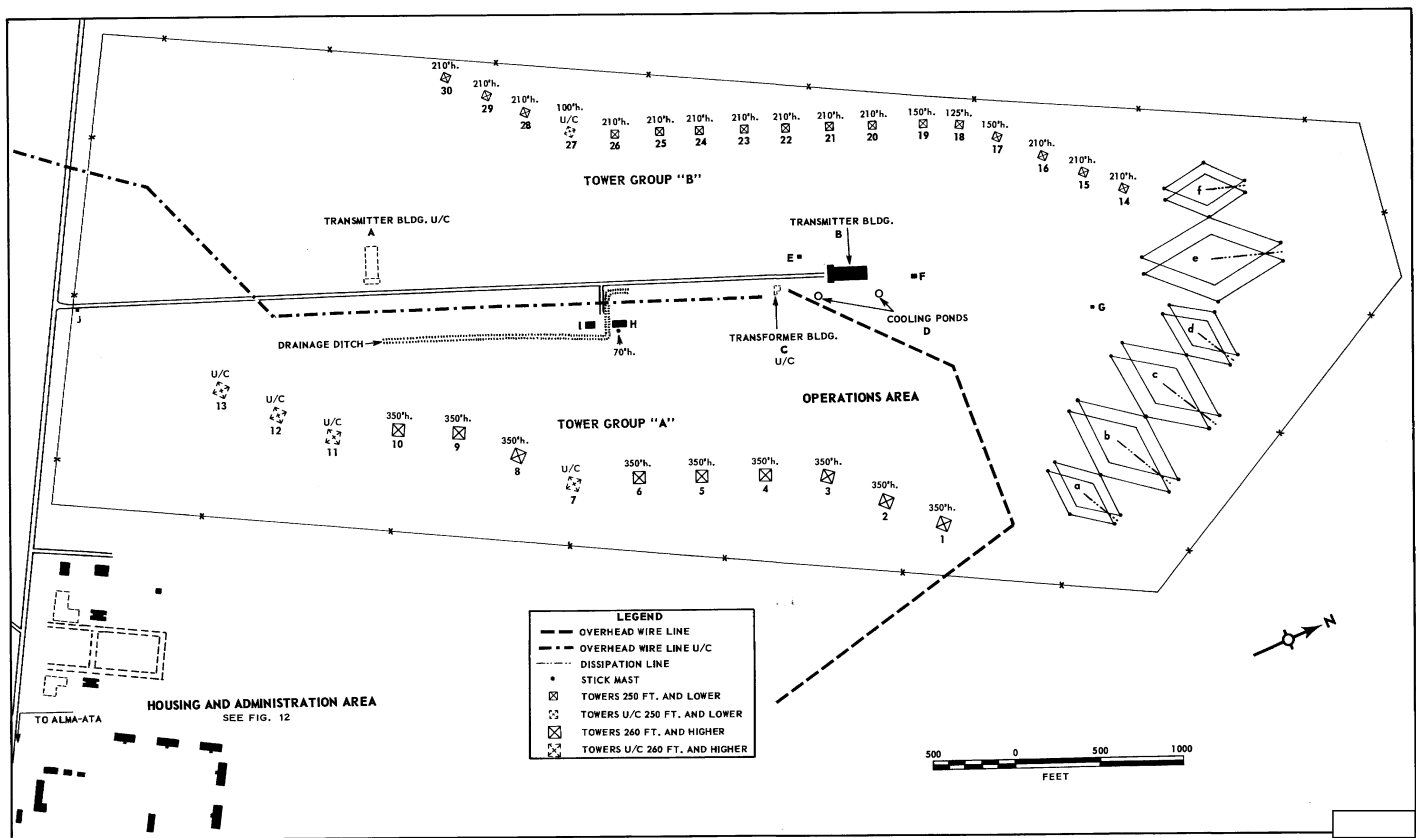


FIGURE 11. OPERATIONS AREA AT THE ALMA-ATA STATION. This plan view shows the 26 self-supporting lattice towers. Note that the second transmitter building is under construction.

map which indicates the general areas which may be covered by the arrays (see Figure 13). Azimuth orientations 130°/310° and [] have been included on the map with the azimuth orientation []

Rhombic Antennas: The six double rhombic antennas (see Figure 11, items a through f), which are located in the northern portion of the operations area, are arranged in three pairs (one day and one night in each pair). Dissipation lines

are evident, indicating that these rhombics are probably utilized for transmitting. Rhombic antenna measurements are given in Table 10, and the azimuthal orientations are shown on the map, Figure 13, page 16.

Structures

The two transmitter buildings (Figure 11, items A and B) are located approximately midway between Tower Groups "A" and "B." For a perspective of this type of building, see Figure 7. Transmitter

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TABLE 10. DATA ON RHOMBIC ANTENNAS, ALMA-ATA						
Antenna	Major Axis (ft.)	Minor Axis (ft.)	Length of One Side (ft.)	Distance Between End Poles (ft.)	Height of End Poles (ft.)	Height of Side Poles (ft.)
a	500	220	275	75	75	75
b	745	330	415	100	105	105
c	760	340	405	95	105	105
d	500	270	285	90	75	75
e	880	470	470	95	105	105
f	550		270	85	75	75

building A is under construction; transmitter building B, however, appears to be completed. Associated with the completed transmitter building is a transformer building under construction (item C), two cooling ponds (item D), two possible tuning houses (items E and F), and one possible switching building (item G). Also within the operations area are several miscellaneous buildings. A 70-foot-high stick mast is adjacent to one of these buildings (item H). A description of each structure is given in Table 11 (building letters are keyed to Figure 11).

TABLE 11. STRUCTURES IN OPERATIONS AREA, ALMA-ATA				
Building	Description	Dimensions (ft.)	Function	
A	U/C		Transmitter bldg.	
B	One story, monitor roof		Transmitter bldg.	
C	One story, gable roof, U/C		Transformer bldg.	
D	Two ponds	55 dia.	Cooling ponds	
E	One story, flat roof		Possible tuning house for one tower group	
F	One story, flat roof		Possible tuning house for one tower group	
G	One story, flat roof		Possible switching bldg. for rhombics	
H	One story, flat roof, w/mast		Possible local communications and administration bldg.	
I	One story, hipped roof		Repair facility	
J	One story		Guard bldg.	

*monitor
**shed

Overhead Power and/or Communication Lines

An overhead wire line enters the operations area from the south. Another line, under construction, enters from the southwest. Both lines terminate at the transformer building (item C). The function of these lines is to supply power and possibly land-line communications to the station. The poles supporting the wire line from the south are 90 feet high and are spaced 520 feet apart. The line from the southwest has its pole-line bases spaced 520 feet apart.

HOUSING AND ADMINISTRATION AREA

South of and adjacent to the operations area is the housing and administration area (see line drawing, Figure 12), which contains 18 buildings. Several of the buildings are incomplete, and in one case, only the foundation is apparent. Six of the buildings are temporary quarters, possibly for construction workers. A description of each building is given in Table 12 (building numbers are keyed to Figure 12).

TABLE 12. STRUCTURES IN HOUSING AND ADMINISTRATION AREA, ALMA-ATA			
Building	Description	Dimensions (ft.)	Function
1	One story, U/C	75 x 50	Undetermined
2	One story, hipped roof	50 x 55	Possible quarters
3	L-shaped, continued	Undetermined	Undetermined

TABLE 12. (CONTINUED)			
Building	Description	Dimensions (ft.)	Function
4	One story, modified H-shaped, hipped roof	80 x 55	Undetermined
5	One story, flat roof	35 x 35	Storage bldg.
6	L-shaped, roof incomple	70 x 50	Undetermined
7	One story, modified H-shaped hipped roof	*115 x 50	Undetermined
8	One story hipped roof	130 x 45	Temporary barracks
9	One story hipped roof	130 x 45	Temporary barracks
10	One story, hipped roof	130 x 45	Temporary barracks
11	One story, hipped roof	130 x 45	Temporary barracks
12	One story, hipped roof	130 x 45	Temporary barracks
13	One story, gable roof	95 x 35	Temporary barracks
14	One story, flat roof	55 x 20	Storage bldg.
15	One story, flat roof	55 x 30	Storage bldg.
16	One story, roof incomplete	90 x 30	Storage bldg.
17	One story, L-shaped valley roof	150 x 30, * 35 x 30	Possible administration bldg.
18	One story, flat roof	80 x 25	Undetermined

*leg

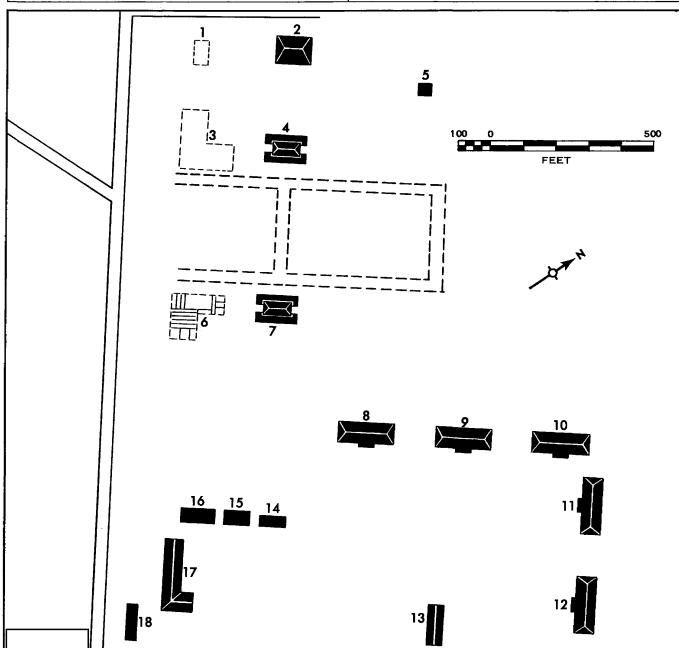


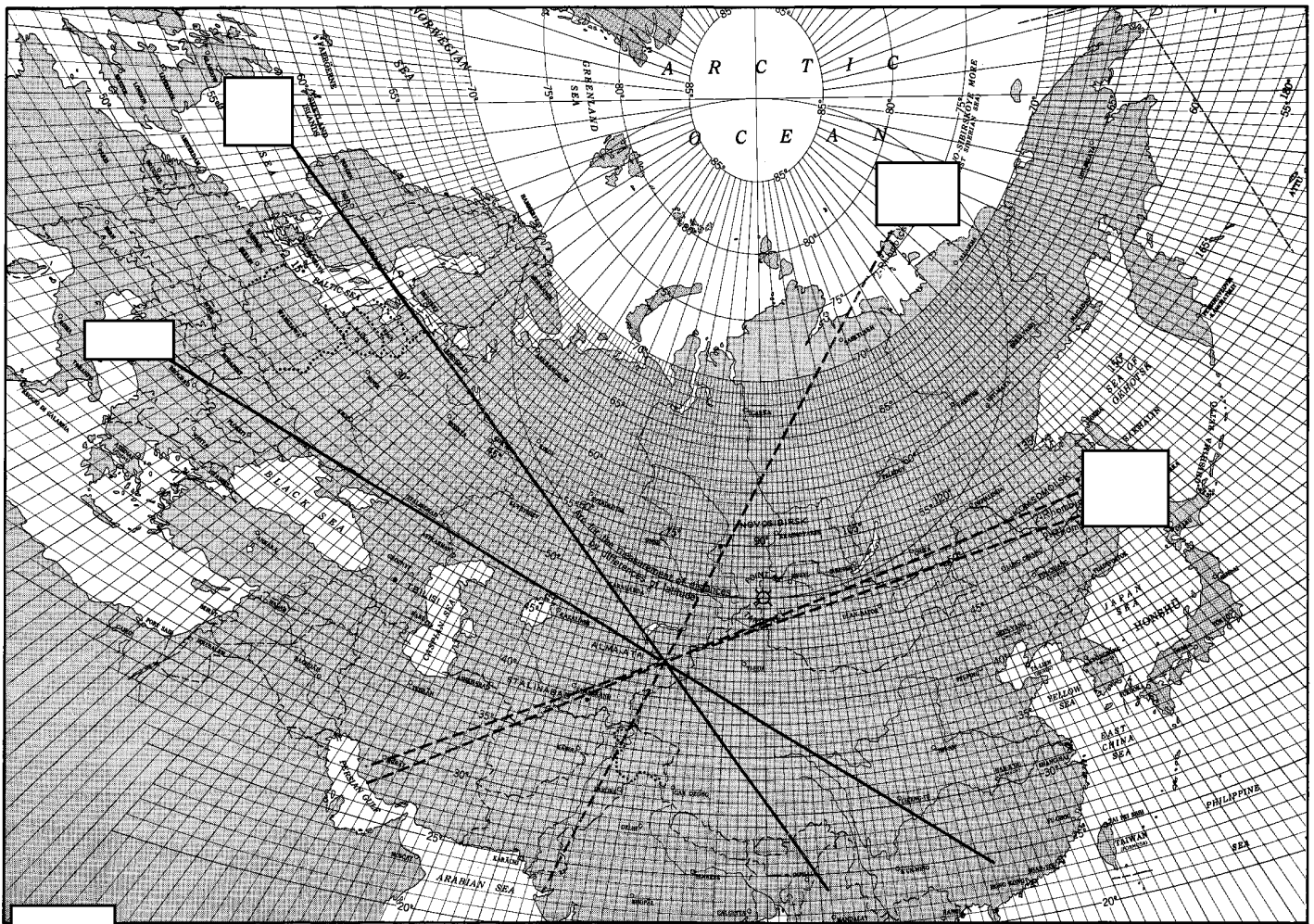
FIGURE 12. HOUSING AND ADMINISTRATION AREA AT THE ALMA-ATA STATION. Figure 11 shows the location of this area in relation to the operations area.

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STALINABAD HIGH-FREQUENCY BROADCASTING STATION

This station is located at 38-29N 68-47E, 6 nautical miles south of Stalinabad (see location map, Figure 14). It consists of a fenced operations area and

istration area, which is adjacent to the operations area and is joined to it by a hard-surface road, contains approximately 40 buildings and several small sheds.

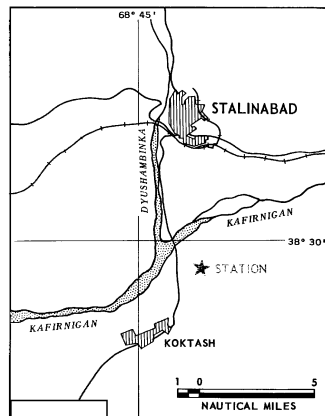


FIGURE 14. LOCATION MAP SHOWING THE STALINABAD STATION.

a housing and administration area (see photograph, Figure 15). The operations area is roughly rectangular and covers approximately 275 acres (6,000 by 2,000 feet). It contains 30 self-supporting lattice towers, arranged in two groups, which support high-frequency curtain arrays; 4 guyed vertical radiators; 2 identical large transmitter buildings, each with two associated cooling towers; one small transmitter building; and miscellaneous storage/support-type buildings. The four guyed vertical radiators and small transmitter building are part of a local broadcasting facility. The housing and admin-

OPERATIONS AREA

Antennas

Curtain Arrays: The 30 self-supporting lattice towers are arranged in two groups, designated as Tower Groups "A" and "B" (see line drawing, Figure 16). Small unidentified objects located between the towers are probable switching and phase-changing devices. Except in measurements, these towers are identical to those at Novosibirsk (see page 9).

Tower Group "A" consists of 15 self-supporting lattice towers (items 1-15). This group is in an L-shaped configuration along the eastern edge of the operations area extending roughly south-southeast to north-northwest. The towers average 350 feet in height and the bases 45 feet on a side. Measured center to center, the towers are [redacted] apart. All but three towers have a 45-foot-long top crossarm (towers 1, 2, and 15 have a 20-foot top crossarm). Smaller crossarms are positioned along the vertical axis of each tower. Measurements for Tower Group "A" are given in Table 13 (tower numbers are keyed to Figure 16).

Tower Group "B" consists of 15 self-supporting lattice towers in a relatively straight line on the western edge of the operations area and roughly parallel

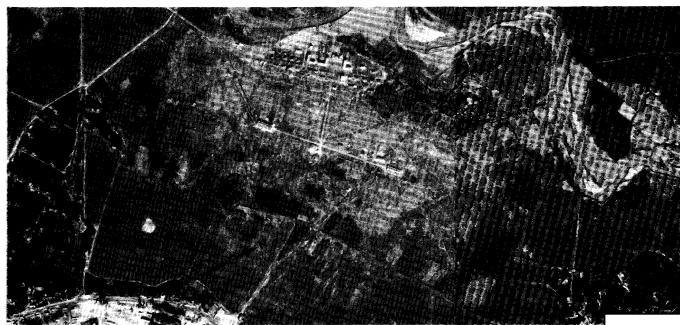
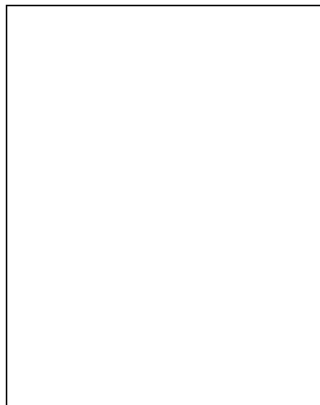
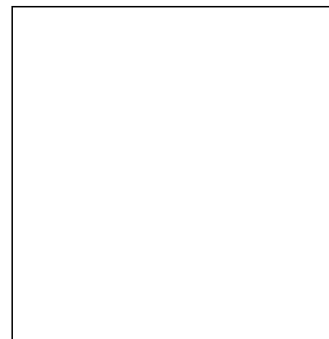


FIGURE 15. PHOTOGRAPH OF THE STALINABAD STATION.

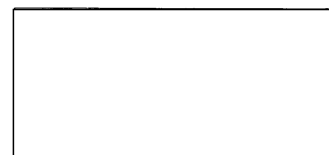


to Tower Group "A." The towers in this group are shorter than those in Group "A." They are 150-240 feet in height, average 250-300 feet apart, and have bases approximately 35 feet square. Each tower has a 20-foot crossarm on top, with additional crossarms positioned along its vertical axis. Measurements for Tower Group "B" are given in Table 14 (tower numbers are keyed to Figure 16).

In Tables 13 and 14, both front and



back azimuthal readings are tabulated. These azimuths are grouped and tabulated for both groups and totaled in Table 15.



The above azimuths have been averaged and plotted on a gnomonic projection map which indicates the general areas

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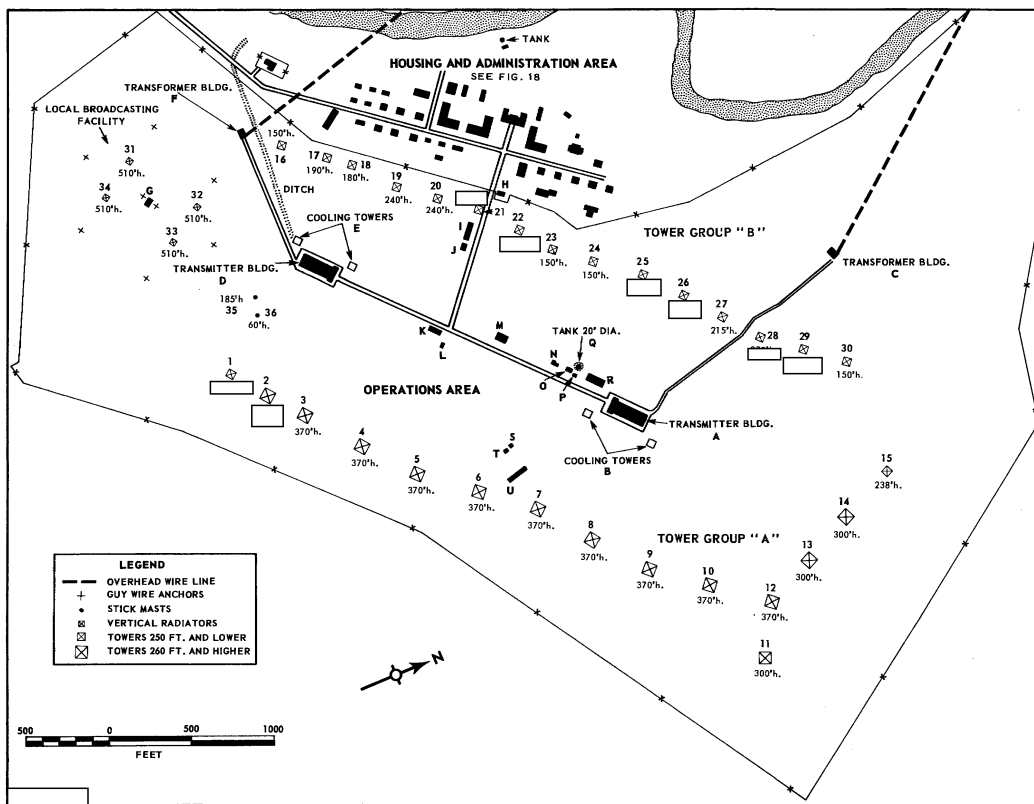


FIGURE 16. OPERATIONS AREA AT THE STALINABAD STATION. This drawing shows the 30 lattice towers.

which may be covered by the arrays suspended from the towers (see Figure 17).

Vertical Radiators: The local broadcasting facility is located in the southwest portion of the operations area. The facility includes the four guyed sectional lattice vertical radiators (Figure 16, items

31-34), each 510 feet high, arranged in a rectangle 475 by 250 feet. There appear to be no cooling provisions for this facility. Centrally located in the rectangle is the transmitter building (item G), 45 by 30 feet.

In addition to the two tower groups and the vertical radiators, there are two stick masts (items 35-36) located roughly

300 feet south of the westernmost transmitter building (item D). One is 185 feet high and the other is 60 feet high.

Structures

The two large transmitter buildings (items A and D) are about 1,830 feet apart

TABLE 16. STRUCTURES IN OPERATIONS AREA, STALINABAD			
Building	Description	Dimensions (ft.)	Function
A	One story, monitor roof	230 x 75, 200 x 20	Transmitter bldg.
B	Two towers	50 x 30	Cooling towers
C	One story, gable roof	50 x 30	Transformer bldg.
D	One story, monitor roof	230 x 75, 200 x 20	Transmitter bldg.
E	Two towers	50 x 30	Cooling towers
F	One story, gable roof	50 x 30	Transformer bldg.
G	One story, flat roof	45 x 30	Transmitter bldg.
H	One story, hipped roof	55 x 35	Guard bldg.
I	One story, shed roof	120 x 20	Storage/repair bldg.
J	One story, shed roof	50 x 20	Storage/repair bldg.
K	One story	85 x 35	Undetermined
L	One story	30 x 10	Undetermined
M	One story, gable roof	65 x 40	Undetermined
N	One story, flat roof w/chimney, L-shaped	40 x 20, 35 x 35	Possible incinerator and storage/repair bldg.
O	One story, gable roof	30 x 30	Undetermined
P	One story, flat roof	10 x 10	Undetermined
Q	Tank	20 dia.	Storage facility
R	One story	100 x 50	Undetermined
S	One story, hipped roof	20 x 20	Undetermined
T	One story, hipped roof	20 x 20	Undetermined
U	One story, shed roof	125 x 20	Undetermined
*monitor			

and are connected by a service road. Each measures 220 by 75 feet and 15 feet high, and has a 200- by 20-foot monitor roof. For a perspective of this type of building, see Figure 7.

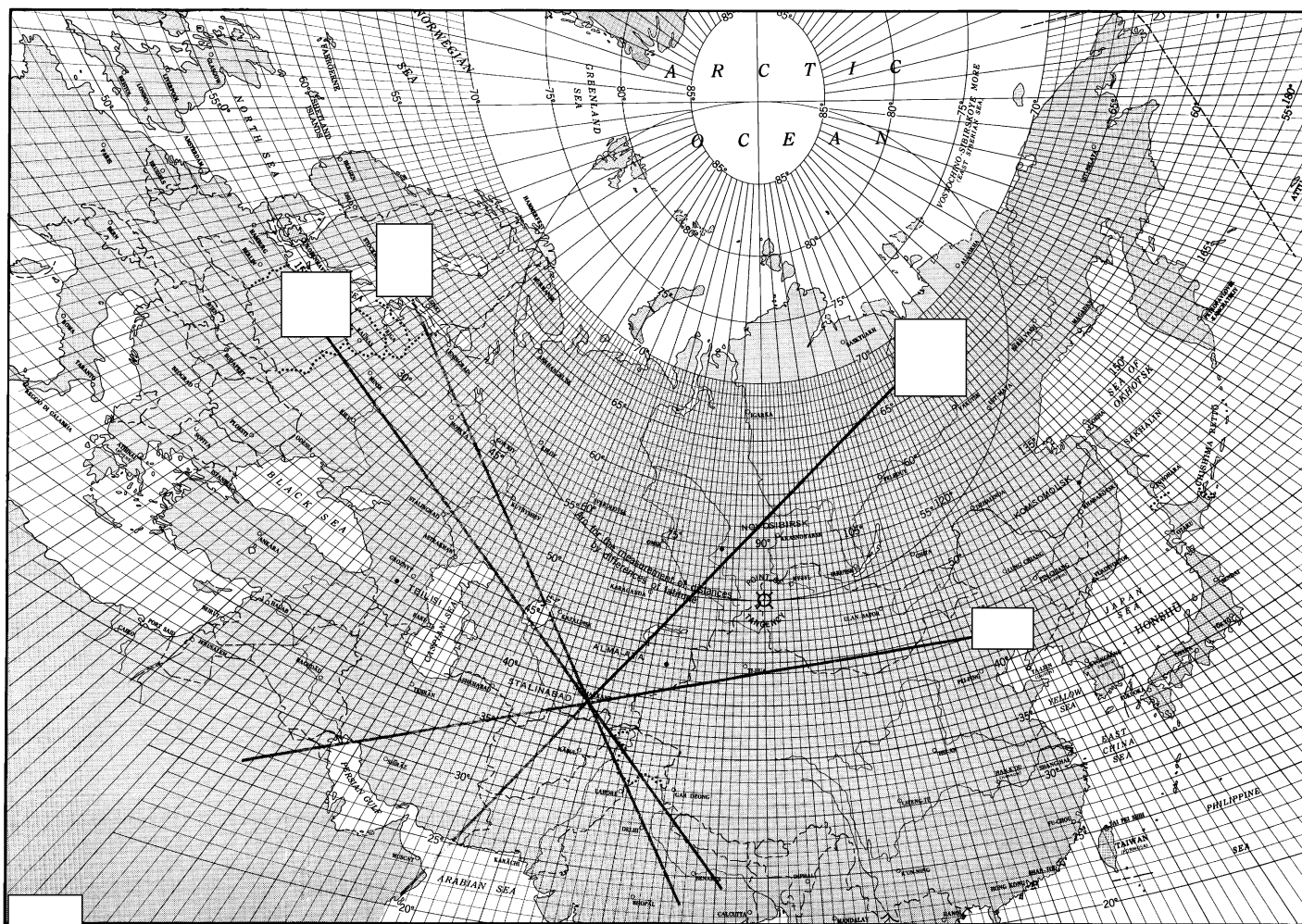
Each large transmitter building has two associated cooling towers (items B and E) and 30 feet high and one transformer building (items C and F). Also, there are several miscellaneous storage/support-type buildings within the operations area. A description of each building is given in Table 16 (buildings are keyed to Figure 16).

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TBILISI HIGH-FREQUENCY BROADCASTING STATION

This station is located at 42°03'N 44°01'E, near the village of Dusheti, 21 nautical miles north-northwest of the center of Tbilisi (see location map, Figure 19). The station includes a fenced operations area and a housing and administration

area (see line drawing, Figure 20). The operations area is rectangular and covers approximately 450 acres (8,500 by 2,300 feet). Security measures for this area consist of a perimeter fence and guard towers. The area contains 36 self-supporting lattice towers, arranged in two groups, which support high-frequency curtain arrays; 2 rhombic antennas possibly under construction; a probable local broadcasting facility; an area of possible stick-mast excavations; 3 transmitter buildings; and miscellaneous storage/support-type buildings.

The station is served by a secondary road, which passes directly through the center of the operations area and the housing and administration area. The road connects the station with the village of Dusheti, 1.5 nautical miles to the north-northeast, and with the Grozny-Tbilisi highway, 2.5 nautical miles to the southeast. Owing to the extreme obliquity of the photography, all measurements included are approximate.

OPERATIONS AREA

Antennas

Curtain Arrays: The operations area is not completely covered by photography, and may contain more than 36 self-supporting lattice towers. Although the towers do not fall into two distinct groups as in the other installations described in this report, the point between towers 20 and 36 has been arbitrarily

selected as a point of demarcation between two groups of towers, designated Tower Groups "A" and "B." Except in measurements, these towers are identical to those at Novosibirsk (see page 9).

Tower Group "A" consists of seventeen 330-foot towers (Figure 20, items 2-16 and 19-20), two 130-foot towers (items 17-18), and one 200-foot tower (item 1) positioned in the southern portion of the operations area. Although each tower apparently supports a crossarm at its apex, the crossarms cannot be measured, owing to halation and extremely small scale. All distinguishable crossarms are oriented at right angles to the tower line. Small unidentified objects located between the towers are probable switching and phase-changing devices. Tower Group "A" measurements are given in Table 18 (tower numbers are keyed to Figure 20).

TABLE 18. DATA ON TOWER GROUP "A," TBILISI

Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
1	200	300	
2	330	265	
3	330	270	
4	330	270	
5	330	275	
6	330	270	
7	330	265	
8	330	275	
9	330	265	
10	330	265	
11	330	265	
12	330	280	
13	330	280	
14	330	275	
15	330	265	
16	330	190	
17	130	190	
18	130	170	
19	330	125	45/225
20	330	225	

*Perpendicular to a line projected between centers of towers; accuracy plus or minus 5 degrees.

**Omitted because power line between the towers indicates probable lack of curtain.

Tower Group "B," positioned in the northern portion of the operations area, consists of eight 130-foot towers (items

26-29 and 33-36) and eight 200-foot towers (items 21-25 and 30-32). Towers 21-25 are located within an area 2,200 feet southwest of tower 26. As in Tower Group "A," the crossarms are apparently present but cannot be measured. Tower Group "B" measurements are given in Table 19 (tower numbers are keyed to Figure 20).

TABLE 19. DATA ON TOWER GROUP "B," TBILISI

Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
21	200	165	
22	200	210	150/330
23	200	210	
24	200	165	125/305
25	200	**	**
26	130	230	155/335
27	130	120	155/335
28	130	225	
29	130	220	
30	200	205	
31	200	190	150/330
32	200	190	
33	130	190	
34	130	170	
35	130	125	45/225
36	130	125	45/225

*Perpendicular to a line projected between centers of towers; accuracy plus or minus 5 degrees.

**Omitted because towers are too widely separated.

In Tables 18 and 19, both front and back azimuthal readings are tabulated. These azimuths are grouped, tabulated for both tower groups, and totaled in Table 20.



The above azimuths have been averaged and plotted on a gnomonic projection map which indicates the general areas which may be covered by the arrays suspended from these towers (see Figure 21). Azimuth orientation has

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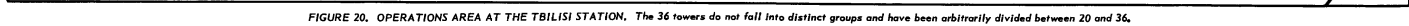


FIGURE 20. OPERATIONS AREA AT THE TBILISI STATION, The 36 towers do not fall into distinct groups and have been arbitrarily divided between 20 and 36.

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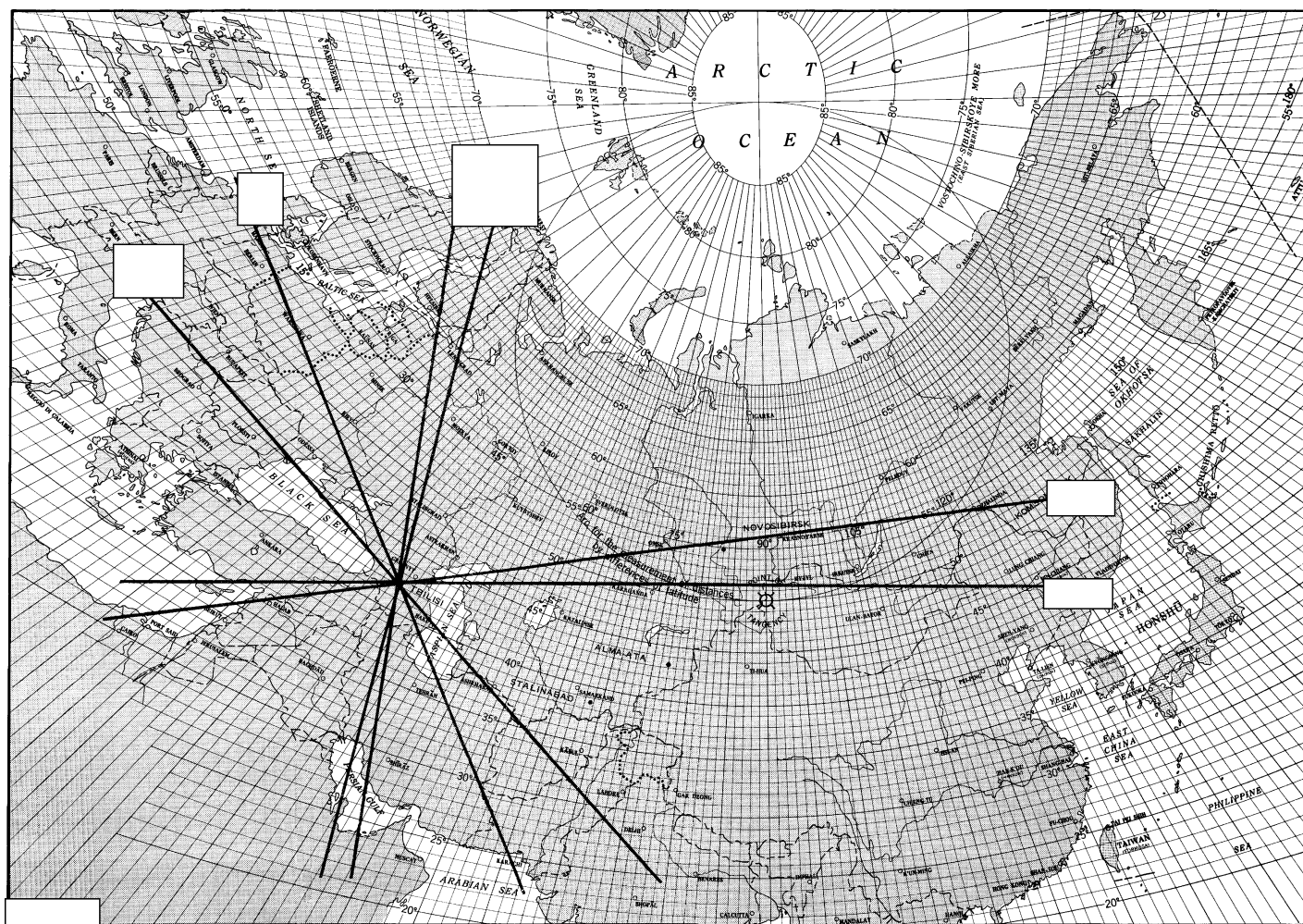


FIGURE 21. GNOMONIC PROJECTION MAP, showing areas covered by antennas at Tbilisi high-frequency broadcasting station.

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been included on the map with the azimuth orientation group [] and azimuth orientation [] has been included with the [] group. No azimuth orientation has been included for a line between towers 18 and 19 in Group "A" because of the existence of a power line passing between the towers which indicates the probable lack of a curtain between them. Also, no azimuth orientation has been included for a line between towers 25 and 26 in Group "B," since these towers are too widely separated.

Between towers 25 and 26 (2,200 feet) there are ground scars which indicate that two rhombic antennas exist or are under construction. The orientation and measurements of these antennas cannot be determined. Between these scars and tower 26 there is a rectangular area, 1,050 by 500 feet, of numerous scars which may be excavations for stick masts and guy-wire anchors.

Probable Vertical Radiator: In the southwest portion of the operations area there is a probable guyed vertical radiator, with a height in excess of 500 feet. A small transmitter building is located nearby (item C). The presence of the vertical radiator with the associated building indicates the existence of a probable local broadcasting facility.

Structures

Besides the small transmitter building, there are two large transmitter buildings (items A and D), identical in size and configuration, situated between Tower Groups "A" and "B." These buildings are approximately 4,000 feet apart and are connected by a service road. For a perspective of this type of building, see Figure 7. Associated with each transmitter building is a transformer building (items

B and E) and two cooling towers (items C and F).

TABLE 21. STRUCTURES IN OPERATIONS AREA, TBILISI

Building	Description	Dimensions (ft.)	Function
A	One story, monitor roof	210 x 65	Transmitter bldg.
B	Undetermined	30 x 20	Transformer bldg.
C	Two towers	Undetermined	Cooling towers
D	One story, monitor roof	210 x 65	Transmitter bldg.
E	Undetermined	30 x 20	Transformer bldg.
F	Two towers	Undetermined	Cooling towers
G	Undetermined	Undetermined	Transformer bldg.
H	One story, probable gable roof	65 x 30	Probable storage and/or maintenance bldg.
I	One story, probable gable roof	30 x 15	Probable storage and/or maintenance bldg.
J	One story, probable gable roof	30 x 15	Probable storage and/or maintenance bldg.
K	One story, probable gable roof	30 x 15	Probable storage and/or maintenance bldg.
L	One story, probable gable roof	30 x 15	Probable storage and/or maintenance bldg.
M	One story, probable gable roof	55 x 30	Probable storage and/or maintenance bldg.
N	One story, probable gable roof	55 x 25	Probable storage and/or maintenance bldg.
O	One story, probable gable roof	50 x 30	Probable storage and/or maintenance bldg.
P	One story, probable gable roof	80 x 30	Probable storage and/or maintenance bldg.
Q	One story, probable gable roof	80 x 30	Probable storage and/or maintenance bldg.
R	One story, probable gable roof	50 x 30	Probable storage and/or maintenance bldg.

*monitor

No feed lines can be identified leading from the transmitter buildings to any of the towers; thus it cannot be determined whether each transmitter building serves a specific tower group. A description of each structure is given in Table 21 (building letters are keyed to Figure 20).

Overhead Power and/or Communication Lines

Two overhead wire lines serve the operations area. Although both lines approach the area from the south, one enters from the south and terminates at transformer building E, and the other enters from the east and terminates at transformer building B. These wire lines supply the station with power and possibly with wire-line communications.

HOUSING AND ADMINISTRATION AREA

The housing and administration area (see line drawing, Figure 22) is located adjacent to the operations area on the northwest. There are 22 buildings of various types. A description of each building is given in Table 22 (building numbers are keyed to Figure 22).

Building	Description	Dimensions (ft.)	Function
1	One story	40 x 30	Undetermined
2	One story	90 x 40	Undetermined
3	One story	130 x 30	Possible Barracks
4	One story	130 x 30	Possible Barracks
5	Multistory, probable hipped roof	65 x 45	Quarters
6	Multistory, probable hipped roof	65 x 30	Quarters
7	Multistory, probable hipped roof	65 x 30	Quarters

continued

Building	Description	Dimensions (ft.)	Function
8	Multistory, probable hipped roof	65 x 30	Quarters
9	One story	90 x 40	Undetermined
10	Multistory, probable hipped roof	65 x 30	Quarters
11	Multistory, probable hipped roof	65 x 30	Quarters
12	Multistory, probable hipped roof	65 x 30	Quarters
13	Multistory, probable hipped roof	65 x 30	Quarters
14	One story, gable roof	60 x 60	Storage bldg.
15	One story, gable roof	55 x 40	Storage bldg.
16	Multistory, probable hipped roof	65 x 30	Quarters
17	Multistory, probable hipped roof	65 x 30	Quarters
18	Multistory	90 x 60	Administration bldg.
19	Multistory, probable hipped roof	65 x 30	Quarters
20	Multistory, probable hipped roof	65 x 30	Quarters
21	One story, gable roof	65 x 30	Storage bldg.
22	One story, quonset roof	60 x 50	Storage bldg.

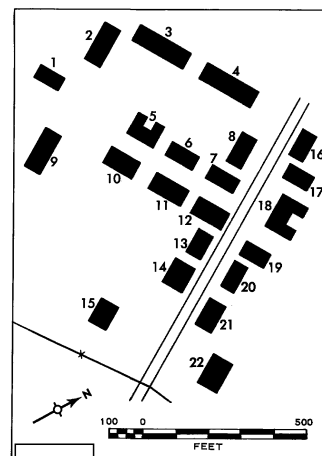


FIGURE 22. HOUSING AND ADMINISTRATION AREA AT THE TBILISI STATION. See Figure 20 for location of this area in relation to the operations area.

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KOMSOMOLSK HIGH-FREQUENCY BROADCASTING STATION

This station is located at 50-39N 136-55E, 2,000 feet east of the Khabarovsk-Sovetskaya Gavan rail line and 7 nautical miles northwest of Komsomolsk (see location map, Figure 23). The station includes a fenced operations area and a housing and administration area (see photograph, Figure 24). The operations area covers approximately 185 acres (3,300 by 2,500 feet). It contains 13 lattice towers, which support high-frequency curtain arrays; a transmitter building; and miscellaneous storage/support-type buildings. The station is served by an all-weather road from Komsomolsk.

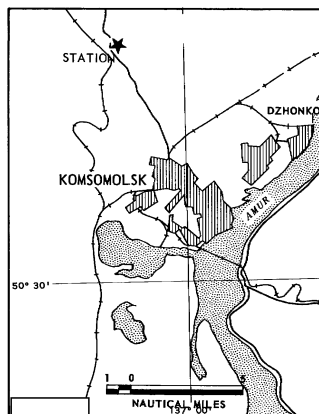


FIGURE 23. LOCATION MAP SHOWING THE KOMSOMOLSK STATION.

OPERATIONS AREA

Antennas

Curtain Arrays: The 13 self-supporting lattice towers are arranged in two groups, designated as Tower Groups "A" and "B" (see line drawing, Figure 25). The two tower groups are roughly parallel, but neither group duplicates the spacing or alignment of the other. Small unidentified objects located between the towers are probable switching and phase-changing devices. Except in measurements, these towers are identical to those at Novosibirsk (see page 9).

Tower Group "A" consists of eight self-supporting lattice towers (items 1-8). Tower bases measure approximately 40 feet square, and top crossarms measure

35 feet long on the tallest towers and 20 feet long on the shorter towers. This group is situated in a relatively straight line along the northeastern edge of the operations area and extends in a north-northwest/south-southeast direction. Tower Group "A" measurements are given in Table 23 (tower numbers are keyed to Figure 25).

TABLE 23. DATA ON TOWER GROUP "A", KOMSOMOLSK				
Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)	
1	260	435		
2	260	375		
3	260	305		
4	260	275		
5	260	370		
6	330	345		
7	330	345		
8	330	430		

*Perpendicular to a line projected between centers of towers.

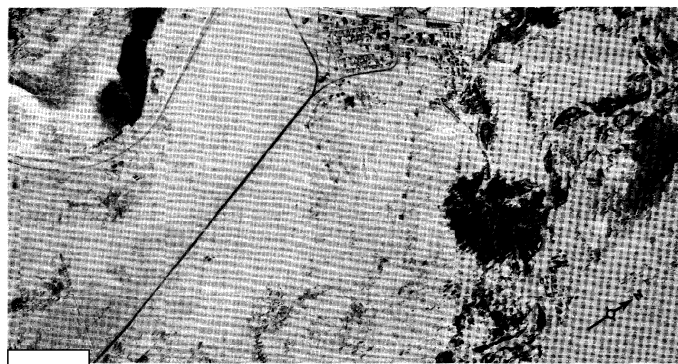


FIGURE 24. PHOTOGRAPH OF THE KOMSOMOLSK STATION.

Tower Group "B" consists of five self-supporting lattice towers (items 9-13). Tower bases measure approximately 40 feet square, and the top crossarms measure 35 feet long on the tallest towers and 20 feet long on the shorter towers. This group is situated in a relatively straight line in the western portion of

TABLE 24. DATA ON TOWER GROUP "B", KOMSOMOLSK			
Tower No.	Height (ft.)	Distance Between Towers (ft.)	Azimuth Orientation* (°)
9	260	270	050/230
10	330	375	
11	330	310	
12	260	285	
13	260		

*Perpendicular to a line projected between centers of towers.

the operations area and extends in a north-west/southeast direction. Tower Group "B" measurements are given in Table 24 (tower numbers are keyed to Figure 25).

In Tables 23 and 24, both front and back azimuthal readings are tabulated. These azimuths are grouped, tabulated for both tower groups, and totaled in Table 25.

The above azimuths have been averaged and plotted on a gnomonic projection map which indicates the general areas which may be covered by the arrays suspended from the towers (see Figure 26).

Structures

A transmitter building (item A) is located in the northwest portion of the operations area between the tower groups. This station differs from the other stations included in this report in that only one transmitter building is present and this building is smaller. Instead of being a one-story monitor-roofed building, it is a one-story gable-roofed building with a multistory end section. Associated with the transmitter building are two cooling ponds (item B), a possible cooling tower (item C), a transformer yard (item D), and three tuning houses (items E, F,

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and G). Feed lines emanate from these tuning houses and terminate at various points within the two tower groups. Also within the operations area are several miscellaneous buildings. A description of each structure is given in Table 26 (building letters are keyed to Figure 25).

TABLE 26. STRUCTURES IN OPERATIONS AREA, KOMSOMOLSK			
Building	Description	Dimensions (ft.)	Function
A	One story, gable roof, w/multistory gable-roofed end section	100 x 40	Transmitter bldg.
B	Two ponds	40 dia.	Cooling ponds
C	Tower	25 x 10	Possible cooling tower
D	Fenced yard	140 x 105	Transformer yard
E	One story, gable roof	15 x 10	Tuning house
F	One story, flat roof	15 x 10	Tuning house
G	One story, flat roof	15 x 10	Tuning house
H	One story, gable roof	30 x 20	Undetermined
I	One story, flat roof	15 x 15	Guardhouse
J	One story, flat roof	30 x 25	Undetermined
K	Cylindrical object	5 dia.	Undetermined

Overhead Power and/or Communication Lines

Two parallel overhead wire lines enter the operations area from the south. Both lines terminate at the transformer yard (item D). These two wire lines supply the operations area with power and possibly with wire-line communications.

HOUSING AND ADMINISTRATION AREA

The housing and administration area is located northeast of and adjacent to the operations area. It supports three additional communication facilities, as well as the high-frequency broadcasting station.

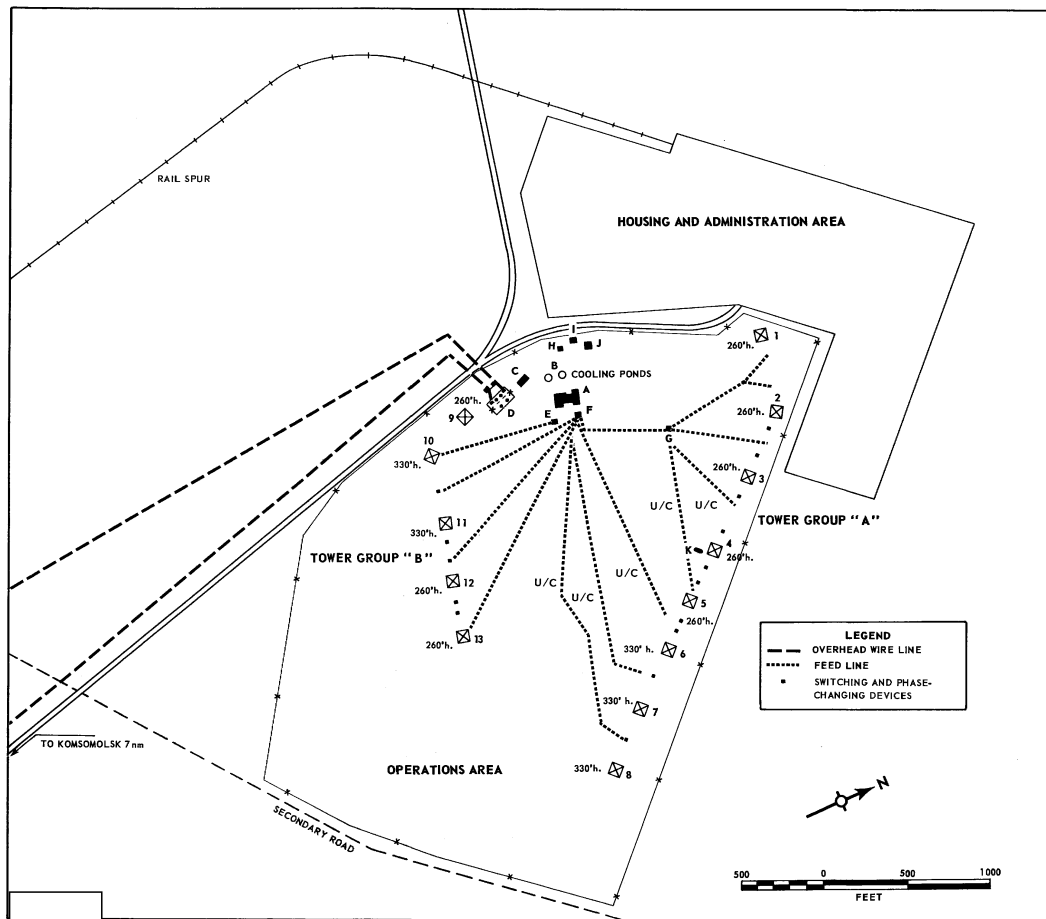


FIGURE 25. OPERATIONS AREA AT THE KOMSOMOLSK STATION. This drawing shows the 13 lattice towers. The housing and administration area serves three additional facilities and is not discussed in detail within this report.

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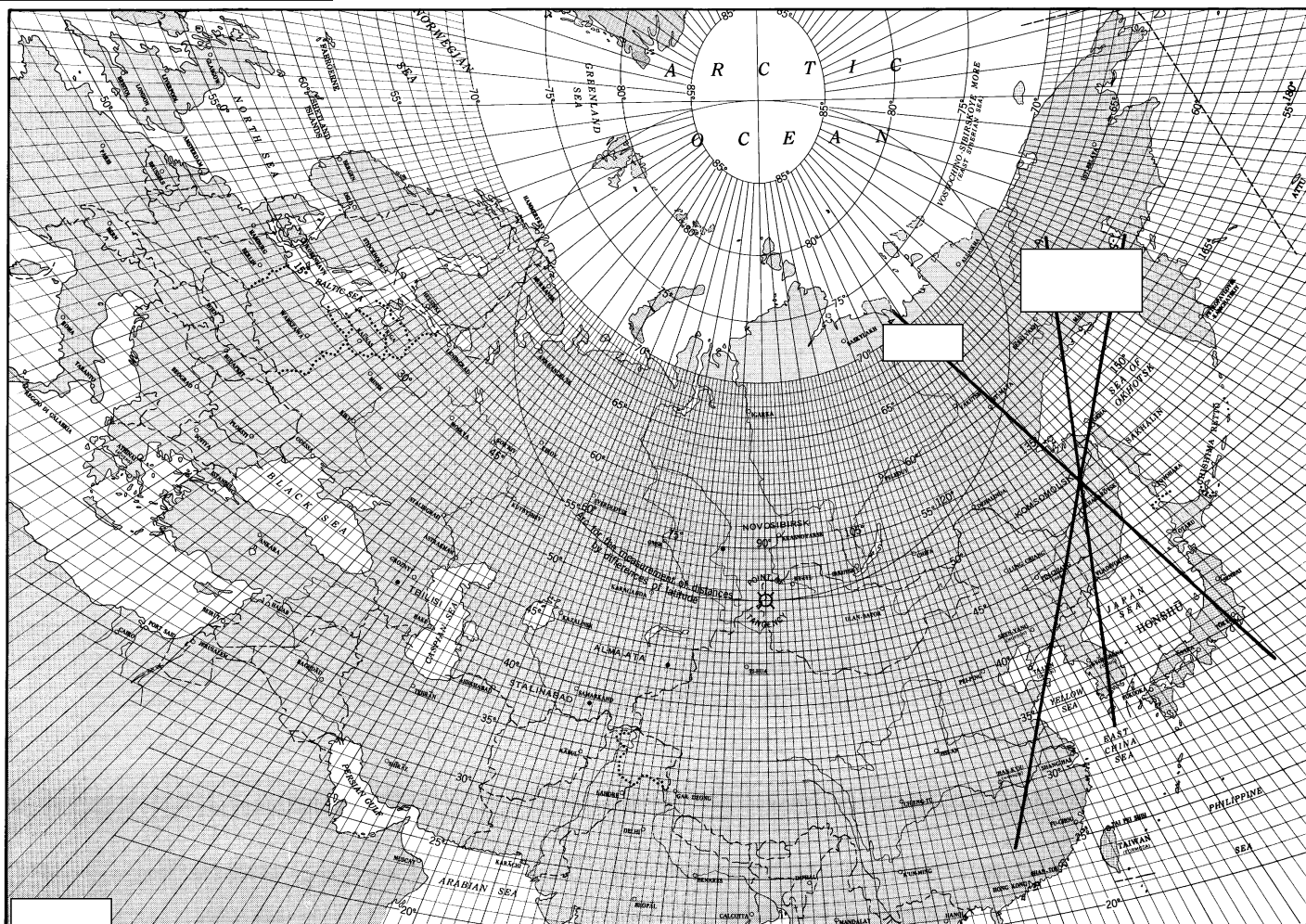


FIGURE 26. GNOMONIC PROJECTION MAP, showing areas covered by antennas at Komsomolsk high-frequency broadcasting station.

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